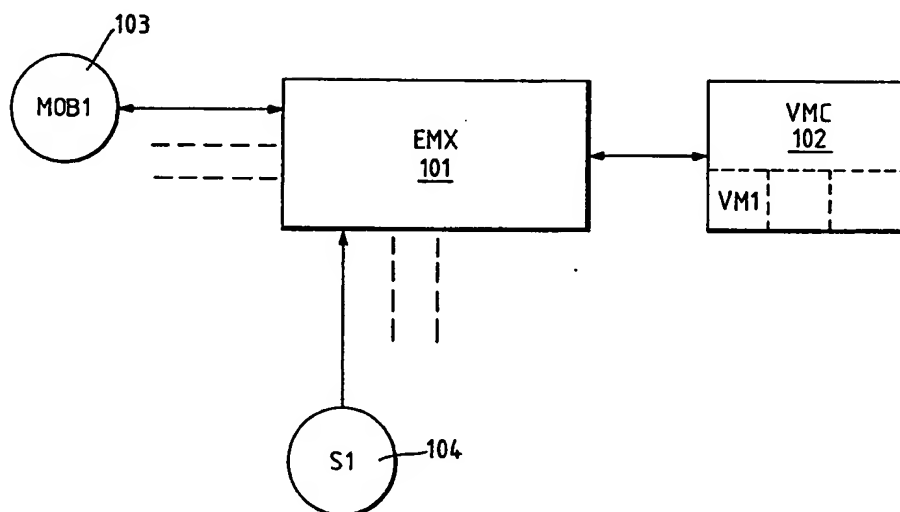




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(54) Title: **CALL COMPLETION SYSTEM**



(57) Abstract

A cellular telephone network comprising an exchange (101) and a voice messaging centre (102) connected to the exchange, the exchange being connectable to a plurality of cellular telephones (103), each having an associated voice mailbox (VM1) at the voice messaging centre (102), the exchange (101) being operable in the event of failure to connect a caller to a desired telephone (103) to divert the call to the voice messaging centre (102) which can record a message from the caller in the associated mailbox (VM1). When such a message has been stored, the VMC transmits a "message waiting" flag for that telephone to the exchange (101). The exchange (101) transmits a "message waiting" signal to the telephone when it registers with a cell of the network, and/or if it initiates an outgoing call.

DESIGNATIONS OF "DE"

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CALL COMPLETION SYSTEM

This application relates to a system for connecting two communications terminals; particularly, but not exclusively, for voice communications; especially by cellular radio voice communication.

It is, of course, annoying when, for some reason, connection to a desired user telecommunications terminal is not possible. This is particularly so with cellular phones, which are often switched off, unattended or out of range, so that resulting call completion rates for land-to-mobile traffic are low (especially at certain times of day).

Messaging services are well known; in particular, in a voice messaging service such as Voicebank (TM), a spoken message is digitally recorded in the mailbox number of the subscriber for whom it is intended, who can then retrieve by himself dialling that mailbox. However, since not every user has a mailbox, voice messaging is not of itself usually an option if a call to a desired user cannot be established. Moreover, a second, different number must be recalled and dialled by the caller, and there is also no guarantee that the called party will play the message. When a user knows that he will be unavailable, he could divert his calls to his voice mailbox, but he must remember to do so and, of course, he may not be aware that he is unavailable (for example, if he is out of range).

According to the present invention, there is, in one aspect, provided a communications system for connecting a first user terminal to a desired one of a plurality of second user terminals and operable if the system is unable

so to connect the first user terminal to store a message from the first user terminal, characterised in that the system includes means for detecting the availability of the second terminal for communication, and is arranged automatically to transmit a message indication signal to the second user terminal when the second terminal is available in the event that that such a message has been stored.

The invention is most useful when the second user terminals are cellular telephones.

In another aspect, there is provided a cellular telephone network comprising an exchange and a voice messaging centre connected to the exchange, the exchange being connectable to a plurality of cellular telephones, the exchange being operable in the event of a failure to connect a caller to a desired said telephone, to divert the call to the voice messaging centre, and the voice messaging centre being operable to record the call, characterised in that the voice messaging centre is operable, when such a message has been stored for a said telephone, to transmit a "message waiting" flag for that telephone to the exchange and the exchange is operable, when such a flag is received, to call that telephone when it is available and to send a "message waiting" signal.

Other aspects of the invention are as claimed.

The invention will now be illustrated, by way of example only, with reference to the accompanying drawings in which:-

- Figure 1 depicts schematically a system according to the invention;

- Figure 2 is a flow diagram of the operation of a system according to a first aspect of invention; and
- Figure 3 is a flow diagram of the operation of a system according to a second aspect of the invention.

Referring to Figure 1, the system comprises at least one exchange (EMX) 101 and at least one (centrally located) Voice Messaging Centre (VMC) 102; whilst these could of course be co-located, it is equally convenient to provide a direct communication link between existing such centres. The exchange (EMX) 101 is connectable to a plurality of subscriber cellular telephones 103 (MOB-1, etc).

Each cellphone 103 on the system would have associated with it a mailbox (VM1) on VMC 102. Mailbox numbers will preferably be identical to the "host" cellphone number.

It will, of course, not be necessary for a user to know his mailbox number; the access to the mailbox is controlled between the exchange (EMX) 102 and the Voice Messaging Centre (VMC) 102.

Referring to Figure 2, when a caller (S1) (104, Fig 1) attempts to call (1) a cellular telephone (MOB-1), he will, if possible (2), be connected (3) as usual. If connection is not possible, the EMX software will check (4) whether, for that telephone (MOB-1), the automatic messaging option is enabled and, if not, terminate the call (5) as in the prior art. If the option is enabled, the exchange (EMX) routes the call (6) to the Voice Messaging Centre (VMC), together with the identity of the mailbox (VM1) corresponding to the cellphone (MOB-1) for

which the message is intended. The caller (S1) (104, Fig 1) can then choose (7) either to leave a message or not; this choice might conveniently be offered by a vocal prompt, and a speaker-independent voice recogniser used to recognise a Yes/No response, or the caller may be allowed to register a 'no' response by terminating the call (hanging up) within, say, 5 seconds of hearing the prompt. If no message is to be recorded, the call is terminated as before (5). If a message is to be left, it is recorded (8) by the Messaging Centre (VMC) in known fashion, and the call is terminated as before (5).

Although the exchange (EMX) transfers a call to the voice messaging centre (VMC), it does not monitor whether a message has been left or retrieved. It is the task of the VMC to monitor the status of each voice mailbox and inform (9) the EMX of any change, by sending a signal to set or cancel a "message waiting" flag at the exchange (EMX). It will be the VMC's responsibility to deal with message housekeeping such as automatic deletion after a given period (e.g. several days or weeks), and to signal any status change to the EMX. The VMC will not set the flag each time there is a new message, only when the status changes from no unread messages to one unread message.

To signal between the EMX and VMC, it would be desirable to use some standard data link such as X-25, but it is acceptable to use a telephony signalling system such as DTMF to transfer a command digit and mobile identity. For the latter, it is proposed that the VMC will dial the EMX over direct trunks and that the EMX will know from the digits sent and the trunk used:-

- a) the mobile identity;

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- b) whether to set or cancel the "message waiting" flag for that mobile.

It must be possible for these flag setting and flag resetting signals to be routed through transit EMXs if necessary as there will not (with mobile users) always be direct connection between each EMX with a subscriber file and the corresponding VMC.

If no message waiting indication is available, cellular telephone users of the invention would be required to regularly access their mailbox to see if any messages have been left. Therefore, in another aspect of the invention, the system automatically indicates to the subscriber when such messages are available.

1. Message waiting indication on call origination

In one such embodiment, the indication would be set when the cellphone originates a call if there are unread messages in the mailbox. Message retrieval or message time-out (e.g. message deletion after 24 hours) cancels the message waiting indication.

2. Message waiting indication on cellphone registration

In a second such embodiment, the message waiting indication would be sent when the cellphone registers. The customer has the option of retrieving messages at this point; the system may allow him to exercise this option by keying, e.g., the SEND key or it may alternatively replay the messages automatically unless he takes some action (e.g. terminates the call).

If a mobile for which a message is waiting registers, then the system will attempt to call the mobile and, if

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the call is answered, send the indication (preferably, a recorded voiced announcement). These calls from the system to the mobile will not be diverted and the action may be limited to one attempt - i.e. not repeated each time the mobile registers.

If the "message waiting" flag is cleared by the VMS and subsequently set again because a new message has been stored, then the system may try calling the mobile after registration.

Referring to Figure 3, one such method of system operation for indicating that a message is waiting will be disclosed.

If the 'message waiting' flag is set (10) and a mobile registers (11), the status of a 'mobile called?' flag associated with the (or each) message is tested (12). The flag will be set if the mobile has already been notified of the or each message but has not read it so that the 'message waiting' flag is still set.

If the 'mobile called?' flag is set, the EMX monitors whether the mobile attempts to call out (13) within a predetermined time. If the mobile makes no call attempts, the EMX takes no further action (but leaves the status of the flags unaltered).

If the mobile is attempting to call out, then upon its connection to the EMX, the EMX plays (14) the 'message waiting' recorded announcement, and then continues call processing as usual (15).

When the call is completed, and whilst the mobile is still registered, if it attempts to originate further calls the EMX returns to stage 13 and the same process occurs.

Returning to stage 12, if there is a message waiting the presence of which has not been indicated to the mobile

user, the EMX tests (13a) as above whether the mobile is attempting an outgoing call and, if it is, the EMX proceeds as above (14,15) (except that the 'mobile called?' flag is reset after the message).

If it is not, the EMX attempts to place a call to the mobile (16). Should the mobile not answer (17) (due, perhaps, to interference) the EMX takes no further steps (and leaves the status of both flags unchanged). It will be appreciated that at this point other actions, such as a second attempt at calling the mobile, could be undertaken.

If the mobile answers, the EMX plays the 'message waiting' recorded announcement (14a) and resets the 'mobile called?' flag. The EMX then tests whether the mobile wishes to hear the message, by waiting a predetermined time (e.g. 5 seconds) and monitoring whether the mobile user has ended the call (18). If he has done so, no further action is taken. If he has not, it is assumed that he wishes to hear the or each message. The EMX therefore connects him to the VMC (19), specifically to his mailbox and instructs the VMC to replay the or each message.

Although the invention could be implemented on a mandatory basis, it is preferred to provide the invention as a selectable mode of operation of a telecommunication system. Preferably, each user terminal is provided with a way of signalling to the system mode for that terminal is desired (ie to turn on or off the call storing).

The Voice Messaging Centre preferably provides the usual known features offered by voice mail facilities, such as 'message replay', or 'message delete'.

Although the invention has been described as applied to cellular telephones, it is in its broadest sense

applicable to other classes of subscriber terminal.
It will be understood that, although voice messaging has been described, the invention could equally be applied to store a voiceband data message or even, where a digital network is employed, to store either voice or data messages in the format in which they are transmitted (for example, ASCII characters).

CLAIMS

1. A communications system for connecting a first user terminal (104) to a desired one of a plurality of second user terminals (103) and operable if the system is unable so to connect the first user terminal (104) to store a message (VM1) from the first user terminal (104), characterised in that the system includes means (101) for detecting the availability of the second terminal for communication, and is arranged automatically to transmit a message indication signal to the second user terminal (103) when the second terminal is available in the event that that such a message has been stored.

2. A system according to claim 1, wherein the second user terminals are cellular telephones (103) and the system includes a cellular radio network (Fig 1).

3. A system according to claim 1 or claim 2, wherein the detection means (101) is responsive to attempts by the second user terminal (103) to initiate communication and the system is arranged so to indicate by transmitting a message indication signal (when necessary) upon such an attempt.

4. A system according to claim 1 or 2 in which the detection means (101) is responsive to registration of the second terminal (103) with said network, and the system is arranged to transmit a said message indication signal, if necessary, when the said second terminal registers.

5. A system according to any preceeding claim, in which each said second user terminal (103) is operable to select a system mode associated with that terminal, the selection being between: a first system mode in which the system is operable automatically to record a said message in the event of a said failure to connect to that terminal; and a second system mode in which the system is not operable to record any such message in any such event.

6. A system according to claim 5 which allocates each second user terminal (103) an associated voice messaging mailbox (VM1) in which said message is recorded, and the second user terminal (103) is operable to select the first mode by transmitting a signal to the system, in which the signal does not identify the associated mailbox.

7. A system according to claim 5 or claim 6 in which second user terminals (103) are associated with the first system mode unless or until, for each, the second mode is selected from the terminal by the user.

8. A system according to any preceeding claim in which the system establishes a call to the second user terminal (103) to deliver said message indication signal, which comprises a recorded voiced message.

9. A method of connecting a first user to a second via a communication network in which, if the second user is available, the two are connected, and if the second user is unavailable, a message from the first is stored, and when the second user is indicated to be available, the message is indicated to be available and/or replayed.

10. A cellular telephone network comprising an exchange (101) and a voice messaging centre (102) connected to the exchange, the exchange being connectable to a plurality of cellular telephones (103), the exchange (101) being operable in the event of a failure to connect a caller to a desired said telephone (103), to divert the call to the voice messaging centre (102), and the voice messaging centre (102) being operable to record the call, characterised in that the voice messaging centre (102) is operable, when such a message has been stored for a said telephone, to transmit a "message waiting" flag for that telephone to the exchange (101) and the exchange (101) is operable, when such a flag is received, to call that telephone (103) when it is available and to send a "message waiting" signal.

11. A network as claimed in claim 10 wherein every said telephone (103) is allocated an associated voice mailbox (VM1) at said voice messaging centre (102) by the network.

12. A network according to claim 10 or 11, in which the exchange (101) is operable to transmit said signal upon the said telephone (103) initiating an outgoing call.

13. A network according to claim 10, 11 or 12, in which the exchange (101) is operable to transmit the said signal upon the said telephone (103) registering with the said network.

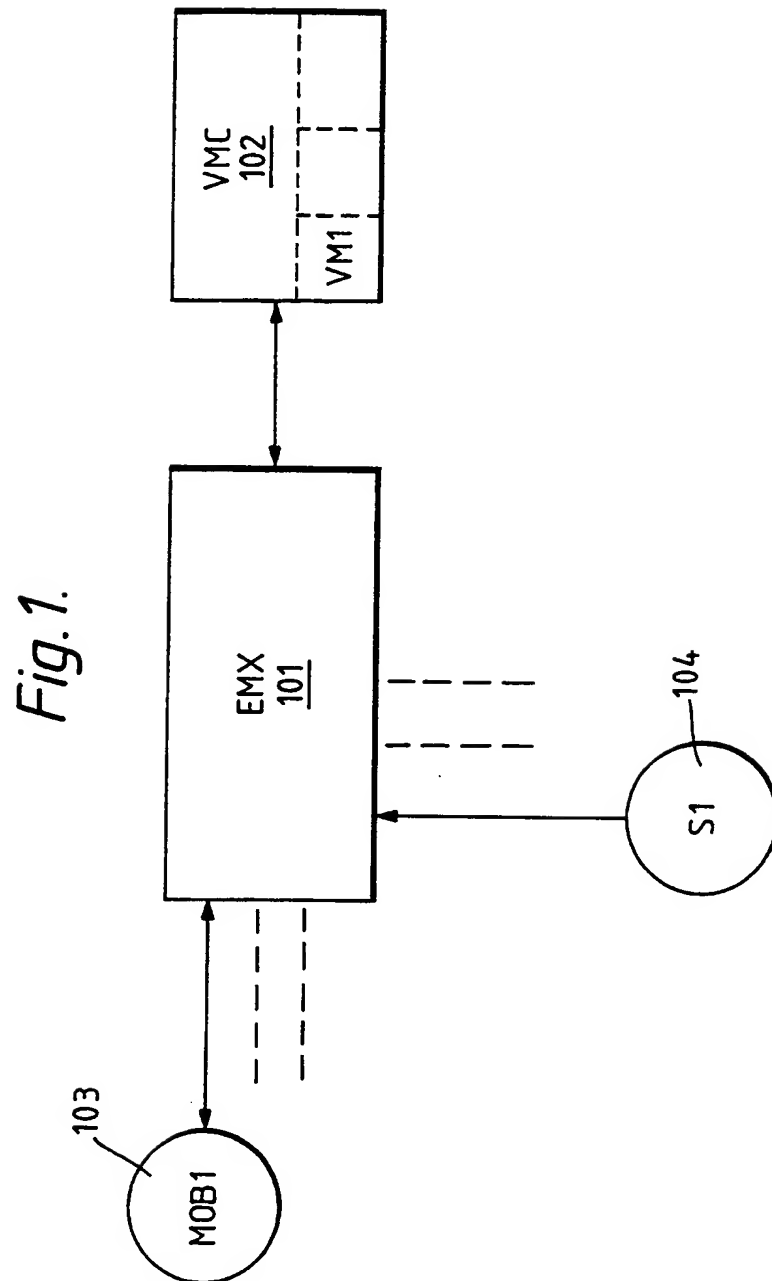
14. A network according to any one of claims 10 to 13 in which the "message waiting" signal is a recorded voiced announcement.

15. A system substantially as herein described with reference to the accompanying Figure 1.

16. A call completion method substantially as herein described, with reference to the accompanying Figure 2.

17. A call completion method substantially as herein described, with reference to the accompanying Figure 3.

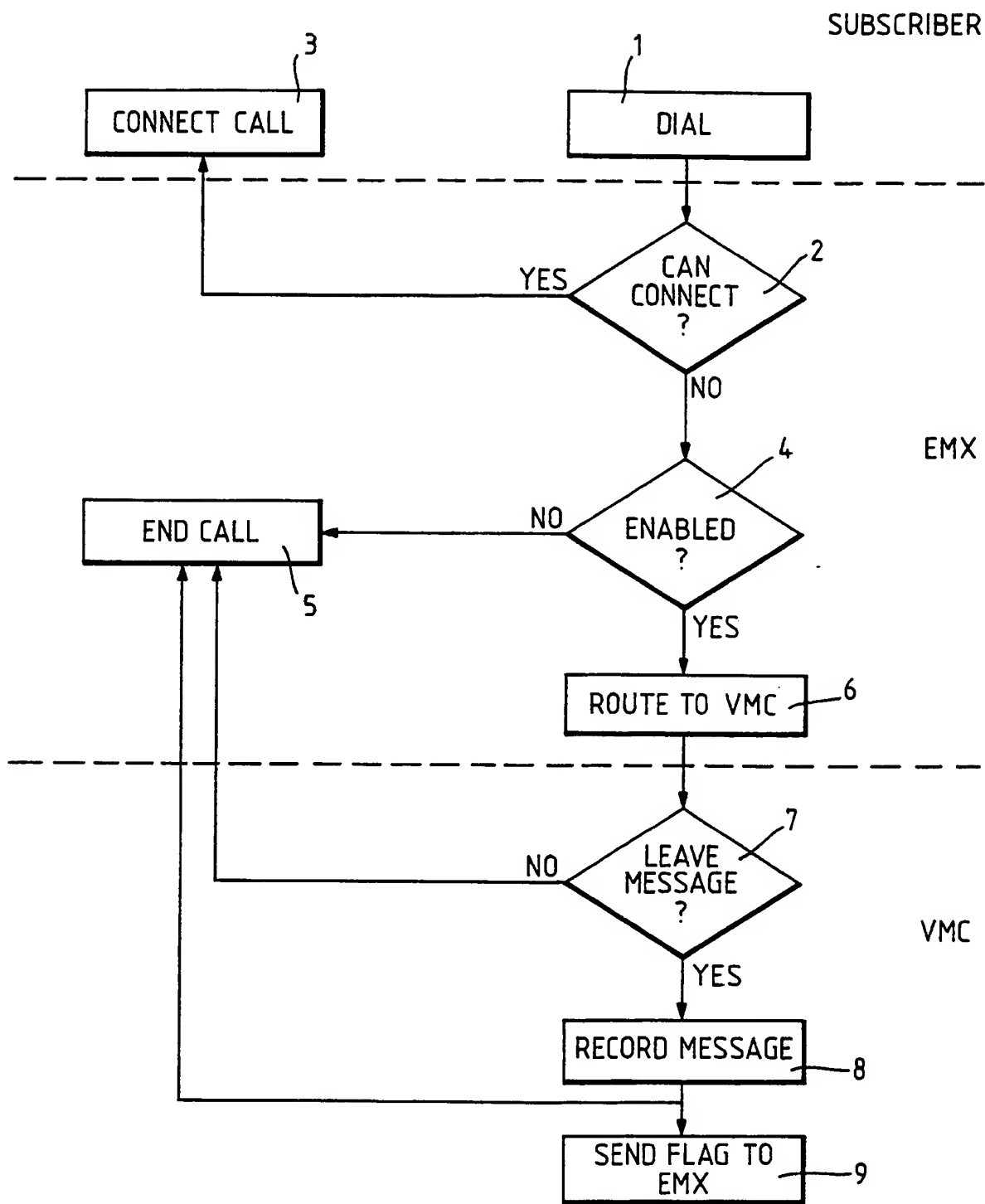
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SUBSTITUTE SHEET

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Fig.2.

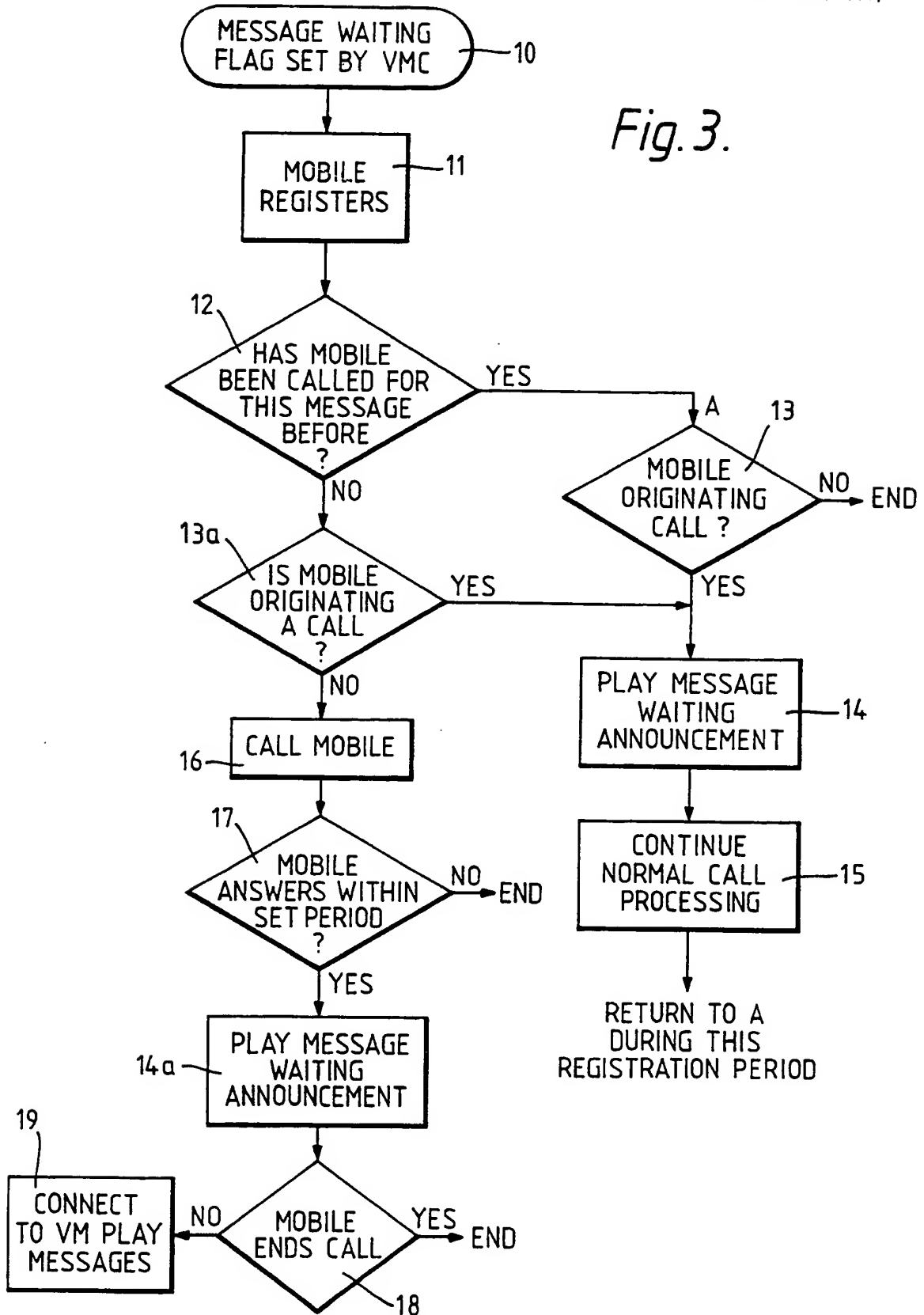


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MESSAGE WAITING ALERT AND MAILBOX ACCESS (ON REGISTRATION)

Fig. 3.



INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 90/01328

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC Int.Cl. 5 H04Q7/04 ; H04M3/50		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
Int.Cl. 5	H04Q ; H04M	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	EP,A,36619 (SIEMENS) 30 September 1981 see page 1, lines 8 - 16	1, 3, 8, 9
Y	see page 3, line 16 - page 5, line 8	2, 10-12, 14
A	see page 6, line 5 - page 8, line 34 see page 9, line 20 - page 10, line 16 see page 12, line 1 - page 14, line 10 see page 14, lines 10 - 35 --- -/-	4-7, 13
<p>¹⁰ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
21 NOVEMBER 1990	04 DEC. 1990	
International Searching Authority EUROPEAN PATENT OFFICE	Signature of Authorized Officer GERLING J.C.J. <i>J.C.J. Gerling</i>	

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
Y	<p>ERICSSON REVIEW. no. 3, 1987, STOCKHOLM SE pages 130 - 140; E.BEDDOES et al: "Cellular Radio Telephony-the Racal-VODAFONE Network in Great Britain." see page 131, right-hand column, lines 20 - 41 see page 133, middle column, line 52 - right-hand column, line 31 see page 134, middle column, line 3 - right-hand column, line 6 see page 135, middle column, lines 7 - 22</p> <p>---</p>	<p>2, 10-12, 14</p>
X	<p>EP,A,112967 (WANG LABORATORIES INC.) 11 July 1984 see page 3, lines 1 - 26</p>	<p>1, 5, 6, 7, 9</p>
A	<p>see page 5, line 17 - page 6, line 9</p> <p>see page 6, line 20 - page 7, line 27</p> <p>---</p>	<p>8, 10, 11, 14</p>
X	<p>INTERNATIONAL CONFERENCE ON COMMUNICATIONS 10-14 June 1979 vol. 1, June 79, BOSTON (US) pages 321 - 325; R.J.NACON et al: "NEW CUSTOM CALLING SERVICES" see page 321, left-hand column, line 1 - page 324, left-hand column, line 17</p>	<p>1, 3, 5, 6, 9</p>
Y		<p>2, 10-12, 14</p>
A	<p>IEEE INTERNATIONAL CONFERENCE ON COMMUNICATIONS 7-10 June 1987 vol. 3, SEATTLE (US) pages 1385 - 1390; K.YAMAMOTO et al: "COMMUNICATION PROCESSING TECHNOLOGY FOR THE MOBILE COMMUNICATION NETWORK" see page 1389, paragraph 5 - page 1390, paragraph 6</p> <p>---</p>	<p>1, 2, 4, 9, 10, 11, 13</p>

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

PCT/GB 90/01328
SA 40111

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A-36619	30-09-81	DE-A- 3011471 DE-A- 3031437 JP-A- 56149164	01-10-81 25-02-82 18-11-81
EP-A-112967	11-07-84	US-A- 4582957 AU-B- 570216 AU-A- 1902383 CA-A- 1207874 JP-A- 59160364	15-04-86 10-03-88 05-07-84 15-07-86 11-09-84